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ABSTRACT

Part of the series "Managing Highway Maintenance," the unit covers the purpose of developing work programs and budgets; a review of the program and budget development process (activity descriptions, feature inventories and quality standards, estimated work quantities, and dollar requirements); and typical calculations for work programs, resource requirements, and budgets. Familiarity with all level 3 training units is advisable before presentation of this unit. The manual format is a lecture outline with the inclusion of related flip charts and handout and discussion materials. (EA)

MANAGING HIGHWAY MAINTENANCE

INSTRUCTOR'S MANUAL FOR WORK PROGRAMS AND BUDGETS

Management by Objectives Series

UNIT 9

LEVELS 1&2

FEDERAL HIGHWAY ADMINISTRATION
Offices of Research and Development
January 1973

This book is part of the series "Managing Highway Maintenance," prepared for the Implementation Division, Office of Development, Federal Highway Administration, under contract FH-11-7600. The series as a whole is described in the *Training Guide and Catalog* volume.

The contents of this book reflect the views of the contractor, Roy Jorgensen Associates, Inc. The contents do not necessarily reflect the official views or policy of the Department of Transportation.

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Implementation Division
Offices of Research and
Development

Washington, D.C.
January 1973

INTRODUCTION

This manual is designed as an aid for instructing maintenance supervisors and foremen in the basics of developing maintenance work programs and budgets.

The subject matter includes:

+ The purpose of developing work programs and budgets;
+ A review of the program and budget development process -- from activity descriptions, feature inventories and quality standards, to estimated work quantities and dollar requirements; and
+ Typical calculations for work programs, resource requirements and budgets.

This manual contains:

+ A lecture outline;
+ Copies of the flip charts used during the lecture; and
+ Copies of handout and discussion materials.

Note: Before presenting "Work Programs and Budgets," the instructor should be familiar with all training units of the Management by Objectives series for Management Level 3. Training Unit 10 of this series is a useful summary of the calculations needed to develop work programs and budgets.

TRAINING OBJECTIVE

Upon completion of this unit, the persons being trained must be able to (1) identify the purpose of maintenance work programs and the basic procedures for developing work programs and budgets, and (2) describe the reasons for calculating resource requirements and making efforts to level the maintenance work load.

LECTURE OUTLINE

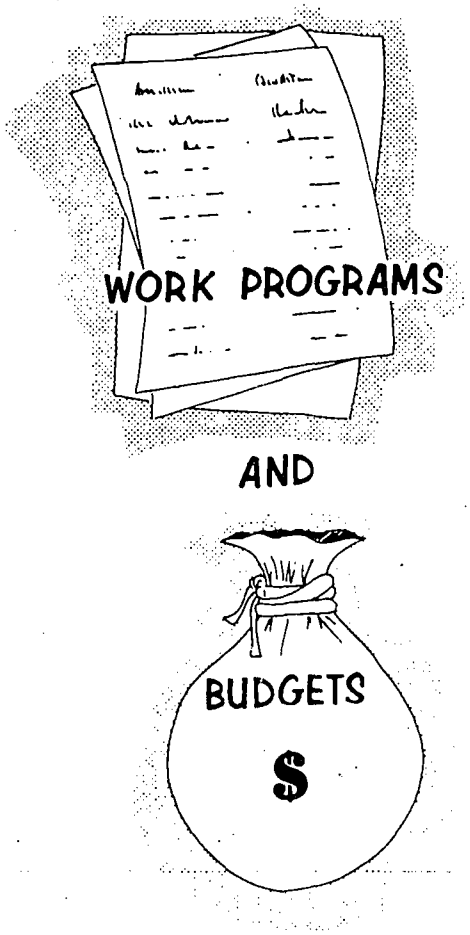
Topic	Approximate Time Needed To Present	Page Number In Manual
Purpose of Work Programs	5 min.	4
Procedure for Developing a Work Program	40 min.	5
+ Take an Inventory of Roadway Features		
+ Apply Quality Standards		
+ Estimate Work Quantities		
+ Calculate the Work Program		
Resource Requirements	30 min.	23
+ Need for Calculating Resource Requirements		
+ Performance Standards and Resource Requirements		
+ Sample Calculations		
+ Sample Work Program and Man-Hour Requirements		
Work Load Leveling	15 min.	31
+ Purpose of Work Load Leveling		
+ Scheduling Calendars		
Budgets	15 min.	34
+ Using Work Programs to Estimate Budget Needs		
+ Sample Calculations		
Summary	5 min.	40

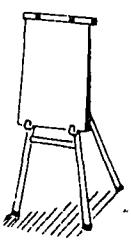
WORK PROGRAMS AND BUDGETS

Note: This is a summarized script for training in work program and budget development. It includes copies of the pre-printed flip charts and sample work program and budget data to be used as handouts. Boxes, such as the one below, show when to use each chart. They also give pointers on what can be done to make the training effective.

Flip charts used in this manual should be enlarged to standard chart size (usually 27" x 35"). Or, if this is not feasible, rough sketches should be drawn to make your points stand out. Handouts may be developed from the Management Data and Maintenance Standards Booklet.

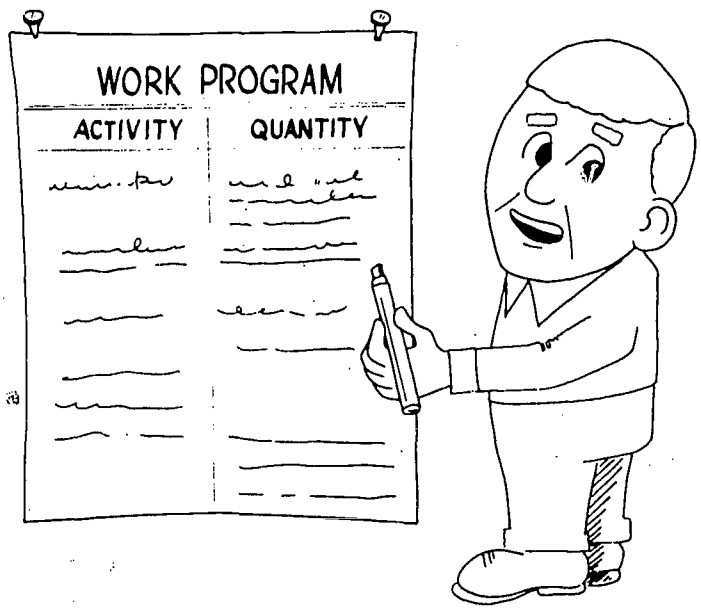
Show Flip Chart #1.





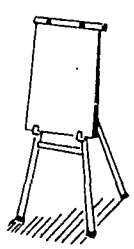
PURPOSE OF WORK PROGRAMS

Show Flip Chart #2.



A WORK PROGRAM IS:

- *AN ESTIMATE OF THE KINDS AND AMOUNTS OF WORK TO BE DONE*
- *YOUR AUTHORITY TO DO WORK*

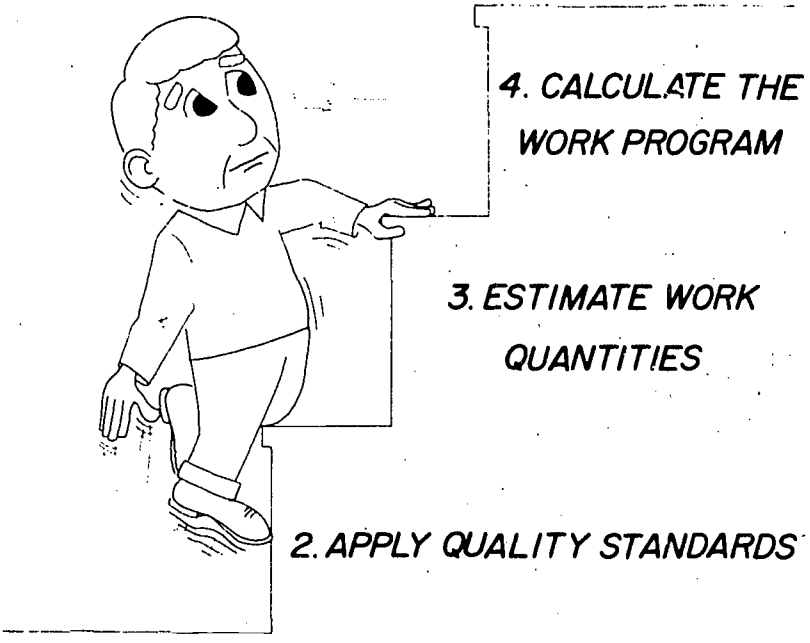


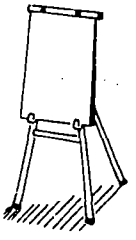
A work program is an estimate of the kinds and amounts of work to be done in the coming year. It is simply a list of the activities the Department performs and the estimated amount of work required for each activity. A work program is also your authority to do the work on the program.

So, a work program not only lists the estimated amounts of work to be done, but it also authorizes you to go ahead and do it.

Show Flip Chart #3.

STEPS IN DEVELOPING A WORK PROGRAM





The procedure for developing a work program has four steps:

Point to each step on Chart #3.

1. Take an inventory of roadway features. The roadway features you maintain are inventoried, or the inventory is updated.

2. Apply quality standards. Quality standards are applied to each feature on the road system.

3. Estimate work quantities. Quantity standards -- and other values -- and the inventory amounts are used to estimate the amounts of work for the program.

4. Calculate the work program. The first three steps are used to calculate the work program.

A list of the Department's activities plus the estimated quantity for each activity make up the work program.

Let's go through these steps -- and develop part of a work program. We will use two activities as examples:

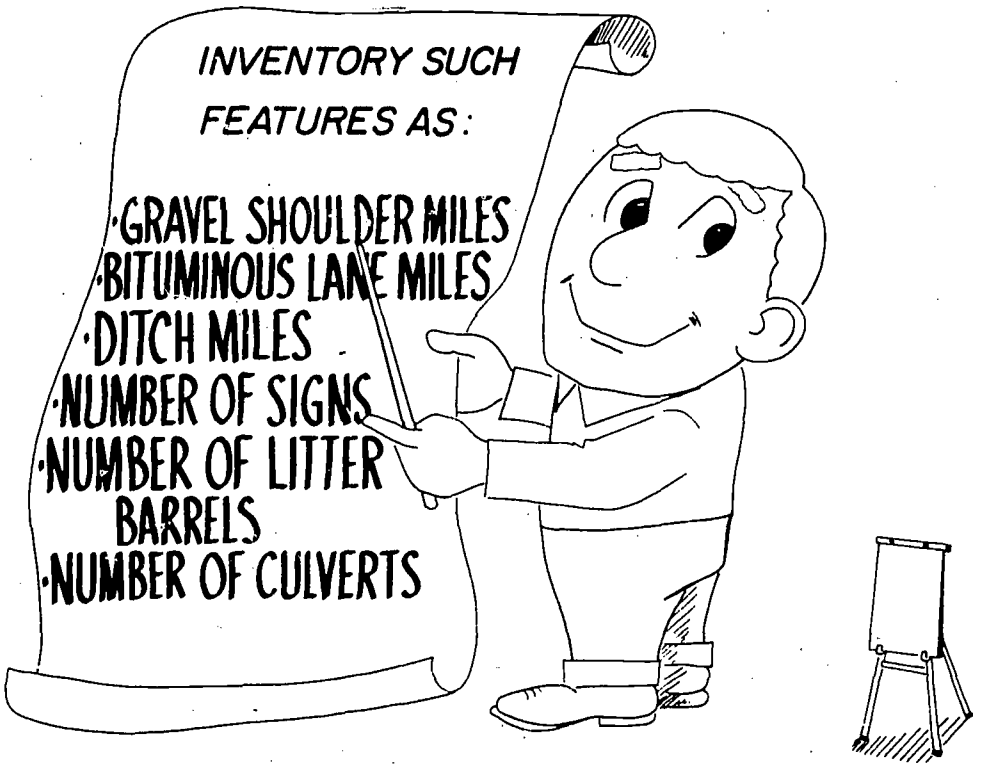
+ Reshaping Shoulders, and
+ Bituminous Surface Replacement.

Both of these activities will be considered a part of the work program for a typical supervisor's area -- Ryan County.

Show Flip Chart #4.

STEP I

TAKE AN INVENTORY



To take an inventory, Ryan County supervisors measure some features -- such as gravel shoulder miles, lane miles of bituminous surface and miles of ditch. Other features are counted -- such as signs, litter barrels and culverts. Usually, the inventory is taken by roadway class. For our purposes roadway classes are:

+ Interstate -- 4-lane, divided roadways
+ Primary -- High-type, 2 or 4 lane roadways
+ Secondary -- Low-type, 2 lane, local traffic roadways.
+ Other -- Spurs, branches, and roads and streets not included in the first three classes

The results of the inventory are pooled to produce the inventory for all of Ryan County.

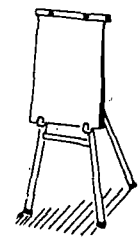
Show Flip Chart #5.

ROADWAY INVENTORY

RYAN COUNTY

INVENTORY UNIT (ROADWAY CLASSIFICATION)	ACTIVITY #113 RESHAPING SHOULDERS (GRAVEL SHOULDER MILES)	ACTIVITY #105 BITUMINOUS SURFACE REPLACEMENT (LANE MILES OF BITUMINOUS SURFACE)
INTERSTATE	———	80.0 1/
PRIMARY	96.0	105.0
SECONDARY	170.0 2/	175.0
OTHER	41.3	———
TOTAL	307.3	360.0

1/ BITUMINOUS *PAVED SHOULDER* NEXT TO CONCRETE SURFACE
2/ SHOULDER WORK PERFORMED FOR SMALL TOWNS



The part of Ryan County's inventory that applies to our two examples -- Reshaping Shoulders and Bituminous Surface Replacement -- look like this.

The instructor should explain the inventory figures and the footnotes on Chart #5.

Step 2 -- Apply Quality Standards

Show Flip Chart #6.

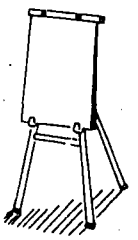
STEP 2

APPLY QUALITY STANDARDS

QUALITY STANDARDS

QUANTITY STANDARDS AND OTHER WORK ESTIMATES

WORK PROGRAM QUANTITIES



For each of the features inventoried, the Department sets a quality standard -- and then converts the quality standard into work program quantities.

Quality standards represent the levels of maintenance that the public wants and the Department can afford -- for each major activity. Quality standards are guidelines that show the circumstances under which work should or should not be done.

A quality standard for shoulder maintenance might be:

> To keep the shoulder flush with the pavement,
> smooth out ruts and provide the proper grade.

Quality standards are used as the basis for determining the work estimates for nearly all maintenance activities. How? Mainly through quantity standards -- which show how much work is needed to reach the quality standards.

Point to Chart #6.

So, quality standards lead to quantity standards and other estimates which lead to work program quantities.

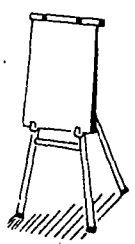
Step 3 -- Estimate Work Quantities

Show Flip Chart #7.

STEP 3

ESTIMATE WORK QUANTITIES

	BY FREQUENCY OF WORK: RESHAPING SHOULDERS	*OR BY WORK QUANTITY ESTIMATES:* BITUMINOUS SURFACE REPLACEMENT
QUALITY ◇	To Keep The Shoulders Flush With The Pavement, Smooth Out Ruts And Provide The Proper Grade	To Correct Broken And Crumbled Surfacing... Except For Potholes, Edge Breaks, And Severe Depressions
QUANTITY ◇	2 Times/Year 6 Pass Miles/Shoulder Mile/Year	2.0 Tons/Lane Mile/Year



Quantity standards can be developed for most maintenance activities. Reshaping Shoulders is an activity that is done on a frequency basis.

We have already said that the quality standard for Reshaping Shoulders might be:

> To keep the shoulder flush with the pavement, smooth out ruts and provide the proper grade.

Through experience and study, the Department may decide that gravel shoulders on primary and secondary roads should be reshaped twice a year to satisfy the quality standard -- "to keep the shoulder flush with the pavement, smooth out ruts and provide the proper grade."

The frequency, then, is that shoulders are reshaped two times per year.

At the same time, the Department figures that it takes about three passes with a grader to reshape one shoulder mile.

So, the quantity standard for Reshaping Shoulders would be:

6 pass miles per shoulder mile per year.

Point to and review the data for Reshaping Shoulders -- on the left side of Chart #7.

Quantities for other activities are also developed. The quality standard for Bituminous Surface Replacement might be:

To correct broken and crumbled surfacing -- except for potholes, edge breaks and severe depressions.

Explain that the exception -- potholes, edge breaks and severe depressions -- are repaired by a separate activity, which has its own quality standard. The quality standard shown on Chart #7 applies only to Bituminous Surface Replacement.

Again, through experience and study, the Department makes a decision as to how much premix it will take during the year "to correct broken and crumbled surfacing" on all bituminous pavement.

Let's say the decision here is 2.0 tons of premix per lane mile per year on all primary roads.

The quantity standard then, for Bituminous Surface Replacement on primary roads is:

2.0 tons per lane mile per year.

The quality and quantity standards for most activities probably would be different for different road classes. For example, secondary roads are more likely to be older and less well built than primary ones and as such, need more work.

So, the quantity standard for Bituminous Surface Replacement on secondary roads might be:

3.2 tons per lane mile per year.

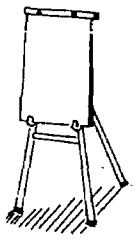
Keep in mind that we are talking about average values. A quantity standard of 2.0 tons per lane mile per year for primary roads does not mean that every single lane mile of bituminous surfacing in that road class will get exactly 2.0 tons of premix -- no more, no less. One 10-mile stretch of roadway may need 100 tons while another 10-mile stretch needs no work at all. The same is true of the quantity standard: 6 pass miles per shoulder mile per year.

Both are estimates of how much work will be needed to reach the quality standards.

Frequency-based and quantity-based activities make up most of the work that is done. But not all.

Show Flip Chart #8.

OTHER GENERAL MAINTENANCE	ADMINISTRATIVE OVERHEAD
INCLUDES:	*INCLUDES:*
· Special Projects · Miscellaneous Activities	· Annual Leave · Sick Leave · Equipment Servicing
Specific Calculations For Each Activity	Specific Calculations For Each Activity
Work Quantities Or Man-Hours	Man-Hours



There are two other kinds of activities that must be shown on a work program -- Other General Maintenance, and Administrative Overhead work.

Other General Maintenance can include:

+ Special projects or betterment work -- such as road widening or repaving, and

+ Miscellaneous maintenance -- work that is rarely done and not standardized.

Estimates for these kinds of work are based on specific calculations for each activity. Because of the different kinds of work included in this activity, the work estimate can be measured in a variety of ways -- tons, cubic yards and in man-hours. But by the time several jobs or activities are included in the work program, the unit of work usually is boiled down to man-hours.

The fourth kind of activity is called "Administrative Overhead." It includes such items as annual leave, sick leave and equipment servicing.

Again, because of the variety of activities involved, this activity's work estimate is also measured in man-hours.

This is a good place to briefly summarize what has been said and to ask if the group has any questions.

O.K., so these are the four kinds of activities that usually make up a work program:

+ Frequency;
+ Quantity;
+ Other General Maintenance; and
+ Administrative Overhead.

At this point in developing our work program, the hard part is done. All that's left is figuring the amounts.

Show Flip Chart #9.

STEP 4
CALCULATE THE WORK PROGRAM

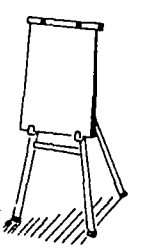
INVENTORY AMOUNT × QUANTITY STANDARD = WORK PROGRAM QUANTITY

RESHAPING SHOULDERS

INVENTORY UNIT : GRAVEL SHOULDER MILES

ROADWAY CLASS	INVENTORY AMOUNT	QUANTITY STANDARD	WORK PROGRAM QUANTITY
INTERSTATE	———		
PRIMARY	96.0	6 PASS MILES/SHOULDER MILE/YEAR	576.0 PASS MILES
SECONDARY	170.0	6 PASS MILES/SHOULDER MILE/YEAR	_____ PASS MILES
OTHER	41.3	3 PASS MILES/SHOULDER MILE/YEAR	_____ PASS MILES

ESTIMATED TOTAL QUANTITY _____ PASS MILES
(ROUNDED TO NEAREST WHOLE NUMBER) _____ PASS MILES



The quantity of work in the program is found by multiplying the inventory amount by the quantity (or frequency) for each activity.

Point to the basic entries on Chart #9 -- as the calculations are discussed.

The inventory shows that Ryan County has 96 miles of gravel shoulder on primary roadways. And we set the quantity standard for Reshaping Shoulders at 6 pass miles per shoulder mile per year.

96 shoulder miles X 6 pass miles per shoulder mile
= 576 pass miles

576 pass miles for primary roads is the yearly work estimate for Reshaping Shoulders -- on primary roads.

What is the estimate for secondary roads?

Ask the trainees to calculate the yearly estimate of pass miles for secondary roadways. Write the figure 1,020.0 in the appropriate space.

The correct answer is 1,020.0 pass miles.

What is the estimate for "Other" roadways?

Ask the trainees to calculate the yearly estimate of pass miles for "Other roadways -- and point out the fact that the "3 pass miles/ shoulder mile/year" represents a different quantity standard than the standards for primary and secondary classes of roads.

The correct answer is 123.9 pass miles.

Add the figures.

These figures added together give us the work program quantity -- 1,719.9 pass miles. Rounded to the nearest whole number, the total work program quantity for Reshaping Shoulders is 1,720 pass miles.

Show Flip Chart #10.

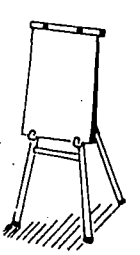
INVENTORY AMOUNT	X	*QUANTITY STANDARD*	=	*WORK PROGRAM QUANTITY*

BITUMINOUS SURFACE REPLACEMENT

INVENTORY UNIT : LANE MILES BITUMINOUS SURFACE

ROADWAY CLASS	INVENTORY AMOUNT	QUANTITY STANDARD	WORK PROGRAM QUANTITY
INTERSTATE	80	0.5 TONS/LANE-MILE/YEAR	_____ TONS
PRIMARY	105	2.0 TONS/LANE-MILE/YEAR	_____ TONS
SECONDARY	175	3.2 TONS/LANE-MILE/YEAR	_____ TONS
OTHER	—		

ESTIMATED TOTAL QUANTITY _____ *TONS*



Let's calculate the quantities for each roadway class for Bituminous Surface Replacement.

What is the estimated work program quantity?

Ask the trainees to calculate the quantities for each roadway class. Then, as the group responds, write the following figures in the appropriate spaces:	
Interstate:	40 tons
Primary:	210 tons
Secondary:	560 tons
Estimated Total Quantity:	810 tons

Here are the correct answers:

Interstate:	40 tons
Primary:	210 tons
Secondary:	560 tons

The estimated work program quantity for Bituminous Surface Replacement is 810 tons.

Show Flip Chart #11.

WHAT GOES INTO A WORK PROGRAM

QUANTITY STANDARDS

(ESTIMATES FOR FREQUENCY-BASED AND QUANTITY-BASED ACTIVITIES)

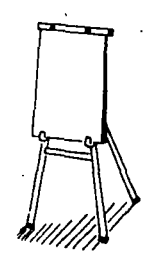
ESTIMATES FOR

OTHER GENERAL MAINTENANCE

\+ ESTIMATES FOR

ADMINISTRATIVE OVERHEAD

A COMPLETE WORK PROGRAM



Work program estimates for two kinds of activities -- those based on frequency and and quantity -- have just been calculated. These kinds of activities make up most of the work program.

Point to Chart #11.

The rest of the program is calculated by estimating the amount of other maintenance and overhead activities required.

Calculations for What Goes Into a Work Program

Distribute Handout #1: Sample Calculations for What Goes Into a Work Program.

All handouts in this manual should be reproduced (on $8\frac{1}{2}$ x 11 paper) before the workshop.

SAMPLE CALCULATIONS FOR WHAT GOES INTO A WORK PROGRAM

WORK PROGRAMS AND BUDGETS
HANDOUT # 1

ACTIVITY NUMBER	NAME OF ACTIVITY	QUALITY STANDARD	ROADWAY INVENTORY DATA CLASS	TOTAL	INVENTORY UNITS	QUANTITY STANDARD	PLANNED QUANTITY	TOTAL PLANNED QUANTITY
113	Reshaping Shoulders	To keep the shoulder flush with the pavement, smooth out ruts and provide proper grade.	Interstate	-	Gravel shoulder miles			
			Primary	96.0	Gravel shoulder miles	6 pass miles/shoulder mile/year	576 pass miles	
			Secondary	170.0	Gravel shoulder miles	6 pass miles/shoulder mile/year	1,020 pass miles	
			Other	41.3	Gravel shoulder miles	3 pass miles/shoulder mile/year	124 pass miles	1,720 pass miles
105	Bituminous Surface Replacement	To correct broken and crumbled surfacing -- except for potholes, edge breaks and severe depressions.	Interstate	80	Lane miles of paved shoulder	0.5 tons/lane mile/year	40 tons	
			Primary	105	Lane miles of bit. surface	2.0 tons/lane mile/year	210 tons	
			Secondary	175	Lane miles of bit. surface	3.2 tons/lane mile/year	560 tons	
			Other	-			-	810 tons

WORK ESTIMATE

159	Other General Maintenance			
	Special Project -- Stabilize Shoulders on Route 276			900 man-hours
	Project Site: From Timmon City limit to 0.62 miles north of city limit -- to reduce severe shoulder rutting in suburban area.	Scarify shoulders. Mix and spread bulk cement with existing material (Rate = 25 pounds per square yard.)	Manpower: 9 (including 2 flagmen) Equipment: 1 motor grader, 1 seaman mixer, 1 dump truck, 2 water trucks, 2 rubber tire rollers, 1 cement hauler (supplied by Acme Construction) Material: 136 tons of bulk cement Estimated Crew Days: 12.5	
	Miscellaneous Maintenance - Isolated Litter Pickup - Painting Sign Posts - Hand Mowing - Pavement Striping - Other Work	(Applicable Quality Standards used)		150 man-hours 150 man-hours 200 man-hours 500 man-hours 300 man-hours 2,700 man-hours
180	Administrative Overhead	(Quality Standards not applicable)		
	Annual leave: 2 weeks Paid holidays: 11 days Sick leave estimate: 2% of total worker Supervision time: 52 weeks Meetings, planning, research, training, etc.			1,280 man-hours 1,024 man-hours 620 man-hours 1,096 man-hours 1,630 man-hours 6,650 man-hours

This handout shows the data we used to figure the work program quantities for Reshaping Shoulders and Bituminous Surface Replacement.

But, as you know, not all quantities of work are figured in this way. Notice the handout also includes data used to calculate quantities for Other General Maintenance operations and Administrative Overhead.

Estimates for these two kinds of activities are based on carefully prepared project estimates, engineering judgment and whatever records are available.

Read and discuss the data for Other General Maintenance and Administrative Overhead from Handout #1.

So, this is an example of how work program quantities are figured for these last two kinds of activities.

When these calculations and estimates are made for all the activities performed by the Department, the result is a complete work program.

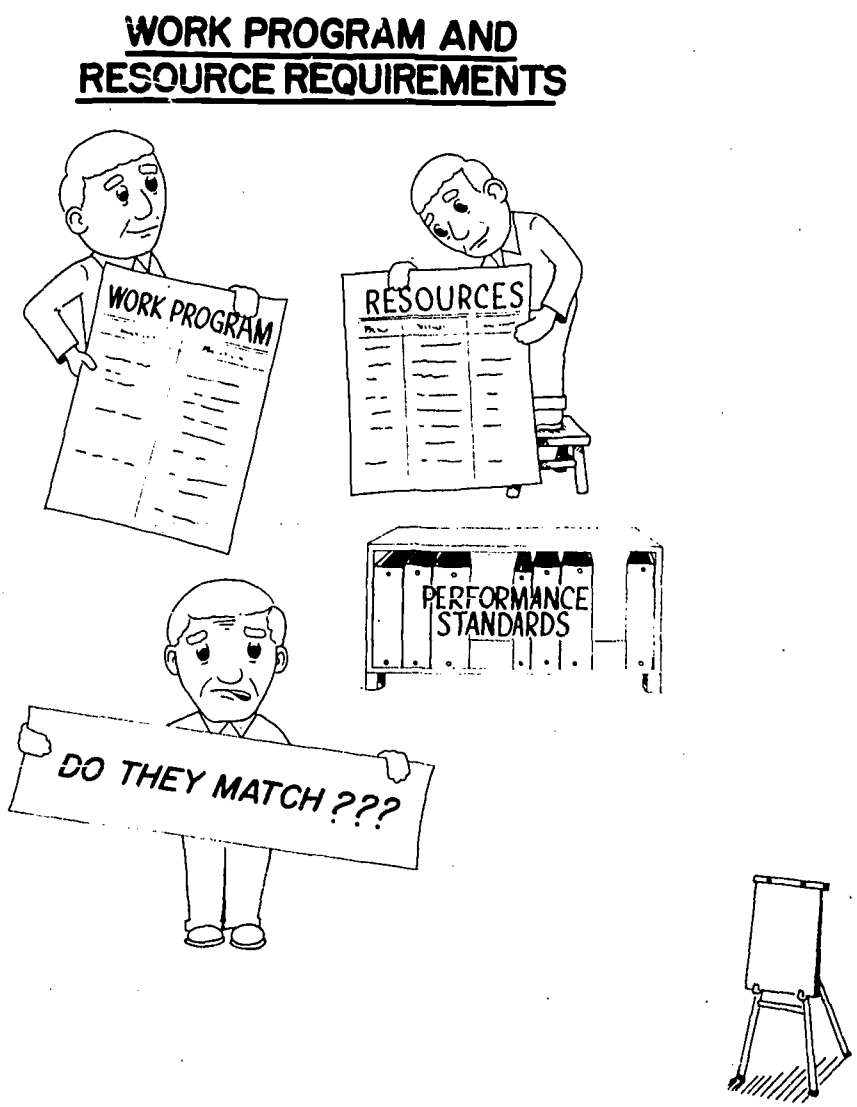
Point to Chart #11.

This is a good place to summarize what has been said and to ask if the group has any questions. Review all of the material until you feel that the group has learned what has been presented.

Then take a coffee break.

We're going to look at Ryan County's completed work program in a minute. But first, let's talk about resource requirements.

Show Flip Chart #12.



The completed work program is the head office's approval to go ahead and do the work.

But it's not going to do much good to start the work if you don't have the right resources available -- the men, equipment and materials needed to accomplish the program.

Resource requirements must be calculated to make sure the work program can be accomplished. And if the program is accomplished, chances are good the quality standards will be reached.

So, to make sure Ryan County has enough manpower, equipment and materials -- to do the job, we need to do some more figuring. We need to find out the number of man-hours, equipment hours and the amount of materials it's going to take to accomplish the work program.

All of the information needed to translate a work program into resource requirements is found in performance standards.

A performance standard shows how many men and machines and how much materials are needed for most activities on the work program. It also describes the results to be expected in terms of daily production and average productivity.

When this information is applied to work program quantities, we can calculate the resources needed.

Show Flip Chart #13.

RESHAPING SHOULDERS

PERFORMANCE STANDARD DATA:

CREW SIZE	:	1
EQUIPMENT	:	1 MOTOR GRADER
MATERIAL	:	NONE
AVERAGE DAILY PRODUCTION	:	8 PASS MILES
AVERAGE PRODUCTIVITY	:	1.0 MAN-HOURS/PASS MILE

CALCULATIONS

MAN-HOURS

WORK PROGRAM QUANTITY × AVERAGE PRODUCTIVITY

1,720 PASS MILES × 1.0 MAN-HOURS/PASS MILE = 1,720 MAN-HOURS

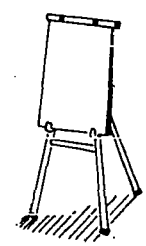
CREW DAYS

WORK PROGRAM QUANTITY ÷ AVERAGE PRODUCTION

1,720 PASS MILES ÷ 8 PASS MILES = 215 CREW DAYS

EQUIPMENT DAYS

EQUAL TO THE NUMBER OF CREW DAYS 215



For example, the performance standard for Reshaping Shoulders lists the following information:

Point to and read the Performance Standard data from Chart #13.

From this information, the following data can be calculated for Reshaping Shoulders.

As they are discussed, point to the entries and calculations on Chart #13.

TOTAL MAN-HOURS = Work Program Quantity X Average Productivity

TOTAL CREW DAYS = Work Program Quantity ÷ Average Production

TOTAL EQUIPMENT DAYS is usually equal to the number of crew days planned. In this case, a motor grader is needed for 215 days -- or maybe two graders are needed for about 108 days.

Show Flip Chart #14.

BITUMINOUS SURFACE REPLACEMENT

PERFORMANCE STANDARD DATA:

CREW SIZE	:	7
EQUIPMENT	:	3 TRUCKS 1 MOTOR GRADER 1 ROLLER 1 ASPHALT KETTLE
MATERIAL	:	PREMIX ASPHALT
AVERAGE DAILY PRODUCTION	:	63 TONS
AVERAGE PRODUCTIVITY	:	0.9 MAN-HOURS/TON

CALCULATIONS

MAN-HOURS

WORK PROGRAM QUANTITY X AVERAGE PRODUCTIVITY

810 TONS OF PREMIX X ____ MAN-HOURS/TON = ____ MAN-HOURS

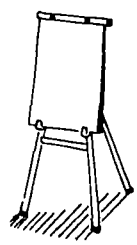
CREW DAYS

WORK PROGRAM QUANTITY ÷ AVERAGE PRODUCTION

810 TONS OF PREMIX ÷ ____ TONS = ____ CREW DAYS

EQUIPMENT DAYS

_____ EQUIPMENT DAYS



Let's work through the calculations for Bituminous Surface Replacement.

Ask the group to make rough calculations for Man-Hours, Crew Days and Equipment Days. As the correct answers are given, write them on Chart #14:

Man-Hours

810 tons of premix X 0.9 man-hours/ton
= 730 man-hours. (Rounded from 729)

Crew Days

810 tons of premix ÷ 63 tons
= 13 crew-days (Rounded from 12.7)

Equipment Days

13 equipment days

The number of equipment days is 13. It means that each piece of equipment is used 13 days. But the calculations we used for Equipment Days do not always hold true. For some activities, some of the equipment may not be needed for the total number of crew-days. So a few detailed adjustments are needed. But generally, these same kinds of calculations can be made for all activities on the work program. Some, of course, already show man-hour estimates. And manpower is the most important resource. If the man-hour requirement is in line with the work to be done (work program), then the rest of the resources usually fall in line, too.

Sample Work Program and Man-Hour Requirements

Distribute Handout #2: Maintenance Work Program and Man-Hour Requirements for Ryan County - 1973.

Here it is -- the complete Maintenance Work Program and Man-Hour Requirements for Ryan County — 1973.

WORK PROGRAMS AND BUDGETS
HANDOUT #2

MAINTENANCE WORK PROGRAM
AND MAN-HOUR REQUIREMENTS
FOR RYAN COUNTY - 1973

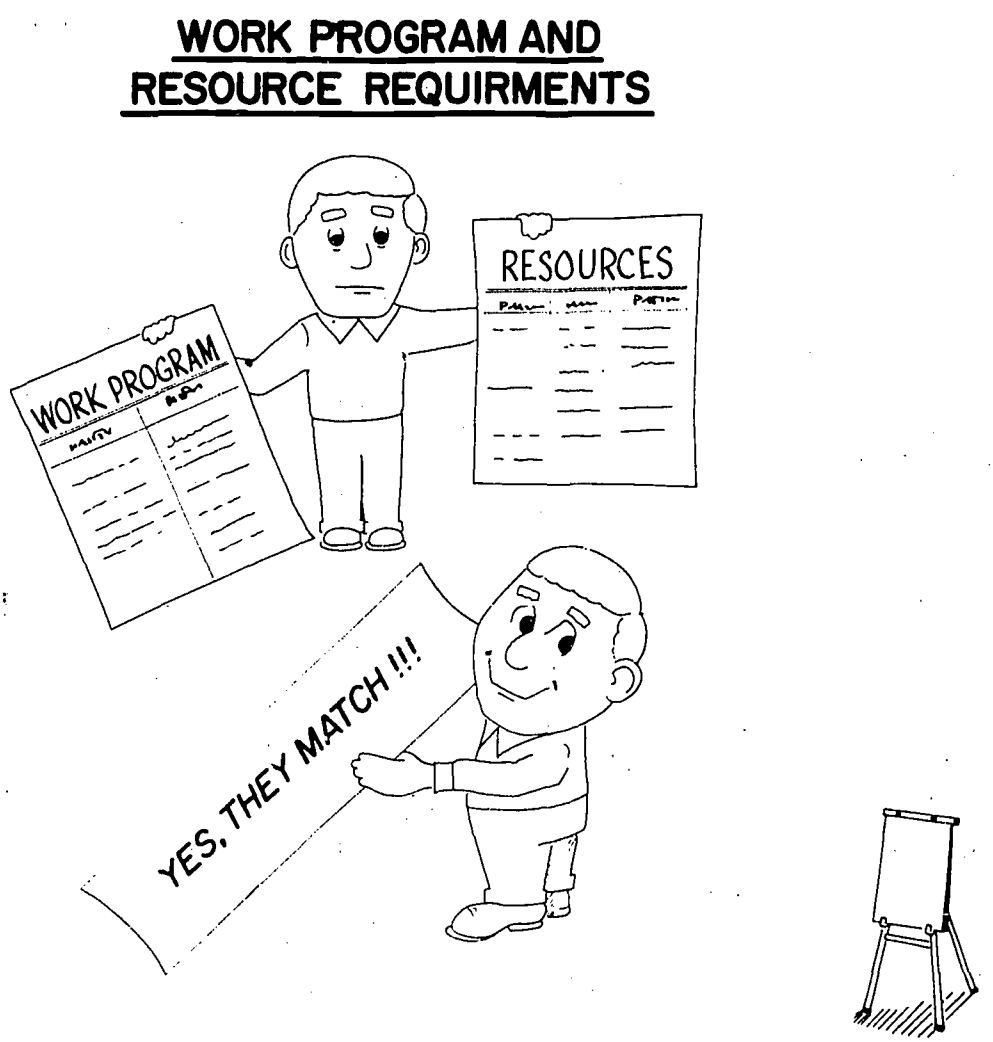
	ACTIVITY NUMBER AND NAME	WORK UNIT	PLANNED QUANTITY	MAN-HOUR REQUIREMENTS
	Surface and Shoulder			
101	Joint and Crack Filling	Gallon of Sealant	775	310
102	Remove/Replace Concrete Pavement	Lane Foot	250	750
103	Premix Patching	Ton of Premix	90	450
104	Spot Sealing	Lane Mile	45	1,125
← 105	Bituminous Surface Replacement	Ton of Premix	810	730
111	Patching Base	Cubic Yard of Material	300	360
112	Spot Patching Shoulders	Cubic Yard of Material	80	360
← 113	Reshaping Shoulders	Pass Mile	1,720	1,720
119	Other Surface and Shoulder Maintenance	Man-Hour	1,900	1,900
	Roadside and Drainage			
120	Tree Removal (Burning)	Inch (Diameter) of Tree	1,895	640
120	Tree Removal (Hauling)	Inch (Diameter) of Tree	950	325
121	Stump Removal	Each Stump	160	480
122	Clean Drainage Structures	Each Structure	580	520
123	Full-Width Liner Pickup	Pass Mile	320	1,280
124	Clean and Reshape Ditches	Ditch Mile	14	2,240
126	Machine Mowing	Acre	2,205	2,205
	Traffic Services			
130	Replace Steel Beam Guardrail	Lineal Foot of Guardrail	85	55
131	Sweeping and Flushing	Mile	125	200
133	Sign Maintenance[1]	Man-Hour	3,280	3,280
134	Signal Maintenance	Man-Hour	810	810
	Maintenance Improvement			
150	General Bridge Maintenance	Man-Hour	605	605
← 159	Other General Maintenance[2]	Man-Hour	2,200	2,200
	Snow and Ice Control			
160	Spreading Salt	Pass Mile	4,010	400
161	Plowing Snow	Pass Mile	3,250	195
	Administrative and Overhead			
170	Building Maintenance	Man-Hour	420	420
171	Ground Maintenance	Man-Hour	800	800
← 180	Administrative Overhead	Man-Hour	6,650	6,650
			Total Planned Man-Hours	31,010

1 Includes 1,050 man-hours required to replace all directional signs.

2 Includes 900 man-hours estimated to do special shoulder project.

Notice the four arrows. These are our examples of the four kinds of activities usually found on a work program and the quantity and man-hour requirements that we calculated.

Show Flip Chart #15.



The calculation of resource requirements is very important because it would be foolish to:

+ Try to accomplish a program with not enough men;

  or

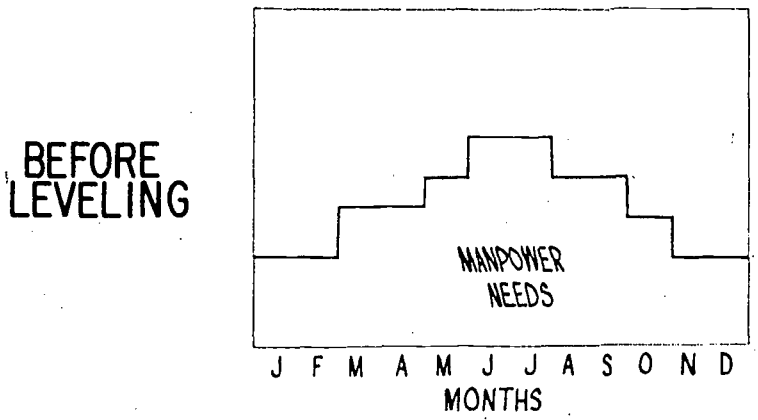
+ To have too many men -- or simply not enough productive work.

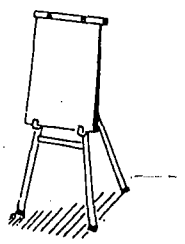
When the work program reflects the desired level of maintenance and is suitable to -- or can be changed to suit -- the manpower and equipment levels, then the program can be put into operation.

The resources match the work program. This sounds good -- and it is. But the problem is that maintenance work is seasonal. So the Department has to try to level the work load -- and balance manpower needs from one month to the next.

Show Flip Chart #16.

MAINTENANCE WORK LOAD





Here is what we mean. Notice that if we don't level the work load, much more manpower is needed in one season than at other times of the year.

So to keep a fairly steady manpower level, the Department tries to distribute the work throughout the year.

Refer to the "Before" and "After" illustrations on Chart #16.

The result of the leveling effort can be put on a scheduling calendar. Let's look at a typical calendar.

Distribute Handout #3: Work Scheduling Calendar.

WORK SCHEDULING CALENDAR

WORK PROGRAMS AND BUDGETS
HANDOUT #3

ACTIVITY NUMBER AND NAME	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Surface and Shoulder												
101 Joint and Crack Filling	■	■									■	■
102 Remove/Replace Concrete Pavem.			▒	▒					■	■		
103 Premix Patching	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
104 Spot Sealing					▒	▒	■	■	▒	▒		
105 Bituminous Surface Replacement			■	■	■	■	■	▒				
111 Patching Base			■	■	▒	▒	▒	▒	■	■	▒	▒
112 Spot Patching Shoulders	▒	■			■	▒	▒	■	▒	▒	▒	▒
113 Reshaping Shoulders			■	■	▒	▒	▒	▒	▒	▒	▒	▒
119 Other Surface/Shoulder Maintn.	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
Roadside and Drainage												
120 Tree Removal (Burning)	■	■									■	■
120 Tree Removal (Hauling)	■	■									■	■
121 Stump Removal	■	■	▒	▒	▒	▒	▒	▒	▒	▒	■	■
122 Clean Drainage Structures	▒	▒	■	■	▒	▒	▒	▒	▒	▒	■	▒
123 Full-Width Litter Pickup	▒	▒	▒	■	■	▒	▒	▒	▒	▒	▒	▒
124 Clean and Reshape Ditches			▒	▒	▒	▒	▒	▒	■	■		
126 Machine Mowing				▒	■	■	■	■	▒	▒		
Traffic Services												
130 Replace Steel Beam Guardrail	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
131 Sweeping and Flushing				▒	■	■	■	▒	▒	▒		
133 Sign Maintenance	▒	▒	■	■	▒	■	▒	▒	▒	■	▒	▒
134 Signal Maintenance	▒	▒	▒	▒	▒	▒	▒	▒	▒	■	■	▒
Maintenance Improvement												
150 General Bridge Maintenance	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
159 Other General Maintenance	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
Snow and Ice Control												
160 Spreading Salt	■	■	■	▒						▒	▒	■
161 Plowing Snow	■	■	■	▒						▒	▒	■
Administrative and Overhead												
170 Building Maintenance	■	■	■	▒	▒	▒	▒	▒	▒	▒	■	■
171 Grounds Maintenance			■	■	■	▒	▒	▒	■	■		
180 Administrative Overhead	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒

LEGEND: ■ Periods of expected performance. ▒ Periods of possible performance. (Blank) Periods when the activity usually should not be scheduled.

A scheduling calendar shows the months of the year when each activity should or should not be done. For example, it shows that Bituminous Surface Replacement (Activity 105) should be scheduled for March through June, might be done during July and August, but should not be done from September through February. What it means is that to level the work load, Bituminous Surface Replacement should not be performed during those months.

It is suggested that one or two other activities be selected and discussed -- using the same reasoning as used for Bituminous Surface Replacement. (Additional background data are shown in the box below.)

BACKGROUND MATERIALS -- WORK LOAD LEVELING

Some activities can be performed only during certain months of the year -- such as spot sealing and mowing. Other activities must be performed throughout the year -- such as pothole patching, replacing guardrail and "supervision." All of these activities are considered fixed.

Some activities must be performed during certain periods, but the work can be shifted around within those periods. Reshaping shoulders and surface replacement are examples. These activities are called semi-fixed.

Some activities can be scheduled at any time of the year -- such as tree removal, employee vacations and some sign maintenance. These activities are considered variable.

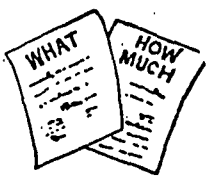
Semi-fixed and variable activities are arranged around the fixed activities -- on the Work Scheduling Calendar -- so that the work load is balanced from one month to the next.

In this way, the work scheduling calendar distributes the work load to the point where peak-season pressures are reduced -- and off-season slack is taken up.

Show Flip Chart #17.

A WORK PROGRAM

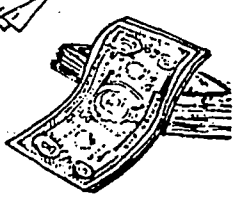
☐ *SHOWS WHAT WORK IS PLANNED AND AUTHORIZED TO BE DONE*

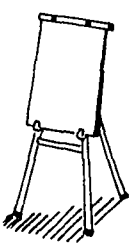


☐ *IS USED TO CALCULATE RESOURCE REQUIREMENTS*

☐ *IS USED TO LEVEL THE WORK LOAD*

☐ *CAN BE USED TO DEVELOP THE BUDGET*





So far, we've seen how a work program is developed and how it is used:

+ To show what work is planned and authorized;
+ To calculate resource requirements; and
+ To level the work load.

The work program has another major use. It also can be used to develop the budget.

You know what the budget is -- money. More specifically, it's the amount of money required to operate the Department for a definite period of time, usually one year.

One way of developing a budget is to calculate the cost of everything we have estimated needs doing in the coming year and add all the costs together for the total estimate.

Budgets which are prepared this way are called performance budgets.

And this is where the work program comes in. When a price tag is put on the resources required to accomplish the work program, a budget can be developed.

Show Flip Chart #18.

RESHAPING SHOULDERS

RESOURCES

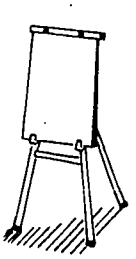
MAN-HOURS	: 1,720
CREW DAYS	: 215
EQUIPMENT DAYS	: 215

COSTS

LABOR	: $3.90/MAN-HOUR
EQUIPMENT	: 1 MOTOR GRADER @ $3.20/HOUR X 8 HOURS/DAY X 215 DAYS
MATERIAL	: NONE

BUDGET NEEDS

LABOR	: $6,708
EQUIPMENT	: 5,504
MATERIAL	: —
TOTAL	$12,212



Here are the resources we calculated for Reshaping Shoulders.

Point to the basic entries as they are discussed -- Chart #18.

The Department applies the resources to the costs of those resources:

$3.90/man-hour X 1,720 man-hours = $6,708

1 motor grader @ $3.20/hour X 8 hours/day X 215 crew-days = $5,504

And there is no material for this activity, so we don't budget for it.

The total cost of the planned amount of shoulder reshaping for the coming year is the sum of the costs of labor and equipment -- $12,212.

If this sort of figuring is done for each activity on the work program, the total amount will be Ryan County's maintenance budget.

Let's figure the costs for Bituminous Surface Replacement.

Show Flip Chart #19.

BITUMINOUS SURFACE REPLACEMENT

RESOURCES

MAN-HOURS	:	730
CREW DAYS	:	13
EQUIPMENT DAYS	:	13
MATERIAL	:	810 TONS OF PREMIX
		150 GALLONS OF ASPHALT

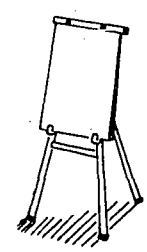
COSTS

LABOR	:	$3.20/ MAN-HOUR
EQUIPMENT	:	3 TRUCKS @ $1.00/ TRUCK/HOUR
		1 GRADER @ $3.20/ HOUR
		1 ROLLER @ $0.50/ HOUR
		1 ASPHALT KETTLE @ $0.50/ HOUR
MATERIAL	:	810 TONS OF PREMIX @ $4.45/ TON
		150 GALLONS OF ASPHALT @ $.11 /GALLON

BUDGET NEEDS

LABOR	:	$ _____
EQUIPMENT	:	_____
MATERIAL	:	_____

TOTAL $ _____



Here are the resources we've already calculated.

Point to "Resources" on Chart #19.

Notice that the 810 tons of premix is taken from the work program. And since asphalt is also used in this activity for tacking, we estimate that 150 gallons will be needed.

Point to "Costs" on Chart #19.

Here are the costs for manpower, equipment and materials for this activity. Use these costs to calculate the budget needs -- and round off your figures to the dollar.

As the correct answers are given, write them in the appropriate spaces on Chart #19:

Labor	$2,336
Equipment	749
Materials	3,620
Total	$6,705

Labor: 730 X $3.20 = $2,336

Equipment:

3 Trucks	3 X $1.00 X 8 X 13 = $312		
1 Grader	1 X $3.20 X 8 X 13 = 333	($332.80)	
1 Roller	1 X $0.50 X 8 X 13 = 52		
1 Kettle	1 X $0.50 X 8 X 13 = 52		$ 749

Materials:

Premix	810 X $4.45 = $3,604	($3,604.50)	
Asphalt	150 X $0.11 = 16	($16.50)	$3,620

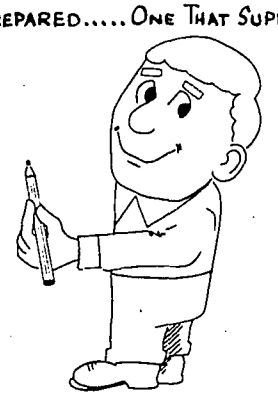
Incidentally, the cost estimates we've used are a matter of record. The wages of employees are on records. The equipment cost is the cost of renting or keeping up equipment, plus the cost of using it. The cost for materials also is easy to find.

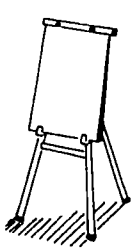
SUMMARY

Show Flip Chart #20.

SEVERAL FINAL POINTS

- A Work Program Shows The Kinds And Amounts Of Work To Be Done
- A Work Program Is Your Authority To Do The Programmed Work
- Resource Needs Are Calculated To Make Sure The Program Can Be Accomplished
- The Work Load Is Leveled To Make Efficient Use Of Resources... Year-Round
- A Budget Can Be Prepared.....One That Supports The Work Program





That's it for work programs and budgets. By now you can see how important a work program really is.

Review points on Chart #20 and conduct a short question and answer session.

— END OF LECTURE-WORKSHOP —